Assessment of the Automated Commercial System (ACS)

Prepared on Behalf of

United States Customs Service

January 14, 1998

Prepared by

GARTNERCONSULTING

GARTNER GROUP
56 Top Gallant Road
Stamford, Connecticut 06904

TABLE OF CONTENTS

Assessment of the Automated Commercial System (ACS)

Table of Contents

1.0 INTRODUCTION

1.1 OBJECTIVES

The United States Customs Service (USCS) has relied on the Automated Commercial System (ACS) for the last thirteen years. Due to the aging system and changes in legislation, the USCS embarked on a re-engineering effort in 1995. This effort was named the Automated Commercial Environment (ACE). The ACE project was positioned as an opportunity to re-engineer the business processes as well as deploy a new system to replace ACS. It has come to the attention of USCS that the ACE project will not be able to be deployed and replace ACS by the Year 2000. Therefore, USCS management is examining their four options which are highlighted below.

1. ACE in its complete and currently defined form.
   This includes all currently defined functionality and deployment at all ports. ACS would continue to be the primary system until the year 2004.
2. ACE light.
   This option would consist of a reduced set of functionality and deployment at a limited number of ports. Some components of ACS would remain and be complemented by the new ACE solution.
3. ACS as is (in its current form).
   This option assumes ACS will continue to be the transactional system for the foreseeable future. This option assumes a minimal expense (non-discretionary) outlay to keep the system operational.
4. ACS with enhancements.
   This option positions ACS as the base system but with enhancements where deemed appropriate. This may include business process improvements found in the ACE environment or other changes dictated by the Trade environment or legislation.

GartnerConsulting has been asked to objectively examine option #3. USCS is performing additional efforts to document the facts surrounding the remaining above options. USCS management will take into consideration all four options and determine the most appropriate path of action.

Our interviews and analysis in this report are squarely focused on option #3. We have not been asked to make judgments on which of the above options is the most appropriate. As defined by USCS, our specific objectives focused within option #3 are as follows:

- Under what conditions (and when) might ACS collapse or performance degrade.
- What activities and associated costs would be required to keep ACS from collapsing.

1.2 APPROACH

Our approach for this engagement consists of three primary phases which are listed below.

Phase 1: Data Gathering
In this phase, GartnerConsulting traveled to USCS offices in Washington, DC and Springfield, VA to interview the appropriate personnel.

Phase 2: Analysis and Report Preparation
Using the information gained in the previous phase, we assimilated the findings and prepared this report focusing on the previously stated objectives.

Phase 3: Present / Review Report
GartnerConsulting will travel to Washington, DC to review, in person, the findings of this report.

The following USCS personnel were interviewed in order to gain an understanding of the ACS's strengths, challenges and to discuss possible solutions.

	Title	Responsibility
	Director of ACE	ACE - Architecture
	Trade Compliance Process Manager	ACE
	Chief, Data Administration Branch	Data Center - Data Admin.
	Program Officer, Field Operations	Volume and Statistics
	ACS Specialist	ACS - Application
	Director of ACS	ACS - Leader
	Program Officer	ACE - Requirements
	Program Analyst	ACE - Implementation
	Chief, Field System Design, ACS	ACS - Business
	Chief, User Acceptance Testing	ACE / ACS - Testing
	Chief, Operating Systems Software Branch	Data Center
	Chief, Computer Operations Branch	Data Center

Additionally, to gain an external view, we interviewed the following "customers" who represent different business segments (i.e., rail, ocean). These customer interviews were performed over the telephone.

	Title	Company
	EDI Director	Chrysler
	Director of Proj. Mgmt	Maersk
	VP, MIS	New Orleans Port Authority
	Manager, Global Trade	Sea Lane

1.3 PROJECT SCHEDULE

This engagement has an aggressive time frame. It began on December 10, 1997 with a report due by the end of December. The report will be reviewed at the end of December and modifications made in the early January 1998 time frame.

1.4 PERSONNEL

The work on this project, including interviews, research, analysis and report preparation, was performed by a team of Gartner Group consultants.

2.0 EXECUTIVE SUMMARY

2.0 EXECUTIVE SUMMARY

USCS is considering multiple options with regard to its strategic path forward for the Automated Commercial Environment (ACE) and the Automated Commercial System (ACS). GartnerConsulting has been asked to examine one of these options, specifically ACS in its current form. Our objectives, as defined by USCS, are to identify under what conditions (and when) might ACS collapse, as well as the activities and costs required to ensure a stable environment.

ACS has grown in size and complexity over its thirteen year history. ACS is currently a mainframe application that consists of 6,000,000 lines of COBOL code, 1000 databases and an environment that processes 500 million database requests per day. Over the years the Trade community has engineered its business processes and systems around ACS. Therefore, any changes made to ACS can have a significant ripple effect throughout the Trade.

In order to discuss ACS in manageable pieces, we will divide it into three components: computer hardware, data and application software.

From a hardware perspective, the USCS data center has proactively addressed the ever-increasing processing demands by upgrading the hardware when appropriate. Currently, USCS uses IBM's most powerful mainframe machines.

From a data perspective, the databases used in ACS are extremely large. This is due to the fact that only a limited amount of data has been archived over the last thirteen years. Therefore, the databases have continued to grow and are encroaching on the physical storage capacity of the machines. Assuming the computing environment stays the same and that the volume of data continues to increase at the historical rate of 20 percent annually, some of the larger ACS databases will reach the physical storage capacity around July 1998. If this capacity were to be reached it would present a critical challenge to ACS as there would be no place to store any new data and the system would need to be shut down. While this issue presents significant risk to USCS, there are multiple archiving solutions available to address this challenge.

From an application software perspective, ACS has two specific areas to address, namely ACS Year 2000 challenges and an internally developed middleware product called MTS. The ACS application development team is currently executing its Year 2000 plan and is on schedule to complete these efforts by 1999. The MTS solution is a complex software application built years ago by USCS with a version of COBOL that is no longer supported by IBM. If replacing MTS is not addressed, the data center may find itself forced into a position of using a non-supported version of the mainframe operating system in order to provide compatibility with MTS. The risks associated with

MTS can be removed by replacing it with IBM's CICS software product. CICS is a product that is currently in use by USCS and supported by IBM.

Regardless of the strategic direction (ACE/ACS) that is chosen by USCS, the ACS system (in some shape or fashion) will continue to be a production system until at least the year 2000. Therefore, we will identify two time frames, 3 years and 10 years, and the associated minimum costs required to ensure a stable ACS environment. Both time frames include ongoing operational support as well as the implementation of the following recommendations:

- Continue with ACS Year 2000 efforts
- Aggressively archive old data
- Replace MTS with CICS.

Over the next three years, in order to address the above-mentioned risk points and provide continued operational support, USCS will need to spend approximately $88,000,000 to operate ACS.

Over the next ten years, in order to address the highlighted risk points as well as provide continued operational support, USCS will need to spend approximately $324,400,000 to operate ACS.

There are other issues that will need to be addressed by USCS but these should be viewed as discretionary and are subject to the strategic direction. Examples of these are:

- Viability of CA Datacom database
- Comprehensive documentation of ACS
- Redesign ACS system components where appropriate
- Identify appropriate solution(s) for decision support functionality.

3.0 ACS BACKGROUND

3.0 ACS BACKGROUND

This section will provide a high-level bulleted summary of ACS. It will include its origins, how it was constructed, what ACS has evolved into, as well as how USCS is organized to support ACS.

History

- USCS began development on ACS in 1980.
- The initial production deployment was February 10, 1984. The functionality of this release was very limited in comparison to its current offering.
- The premise of ACS was the automation of the existing manual / paper process. This included the capture of detailed data items.
- In addition to being primarily a transactional system, ACS does provide some decision support capabilities (i.e., online reports / queries).
- ACS is built using COBOL as the development language and the Computer Associates (CA) Datacom product as the database management system.
- A contractor who was part of the systems origin and its history was Keane Federal Systems (who has since been replaced).
- ACS is currently utilized in all USCS locations / ports as well as by many Trade partners.
- At the beginning, documentation was given a high priority. Over time however, due to time constraints, the development staff concentrated on delivering functionality and documentation was considered a less critical item.
- ACS continued to evolve over time as functionality was added to meet the business requirements. Initially, the functionality increments were architecturally clean but, as time went on, it became difficult to keep the system's purity. Contributing factors to this lack of architectural purity were pressures to deliver functionality, aggressive delivery dates, minimal documentation and the growing complexity of the system.
- Around 1993 there were several new factors being introduced into the USCS environment, namely:
  - Future Automated Commercial Environment Team (FACET): A team that was focusing on what the USCS environment would look like if they were able to take a "green field" approach (i.e., clean slate).
  - Modernization (Mod) Act: Legislation that itemized new ways in which USCS would interact with the Trade. For example, USCS would not deal at a transactional level but instead would now work with the Trade on an "account" based (summary) mode.
  - North American Free Trade Agreement (NAFTA).

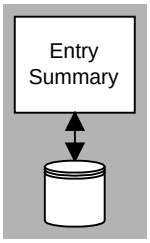
- These efforts led to the formation of the Automated Commercial Environment (ACE), which was a full-time team dedicated to identifying the new business processes that USCS would embrace.
- In 1995, the ACE team evolved into an effort that was assigned the task to build the replacement computer system for ACS. This was not seen as an evolutionary task but rather a revolutionary effort that would "replace" ACS.
- Obviously at this point in time, ACS was not the focus of funding or personnel resources. Some personnel from the existing ACS team were assigned to the ACE project.
- The ACS team size was reduced and the application was put into a "maintenance" mode. It was viewed by USCS that ACE would replace ACS before the Year 2000.
- In April 1997, Keane Federal Systems and their 70 people were replaced by CompuTech as the contractor who would support ACS. This presented quite a challenge to ACS as they now had a minimally experienced staff to keep the system running and perform mandatory enhancements.
- In 1997, it was identified that ACE would not be able to replace ACS before the Year 2000. This resulted in a new and significant effort to address the Year 2000 challenges that exist in the ACS system.
- CompuTech has ramped up to 60 people and the ACS team (CompuTech and Customs employees) are executing a significant Year 2000 effort.

Current State

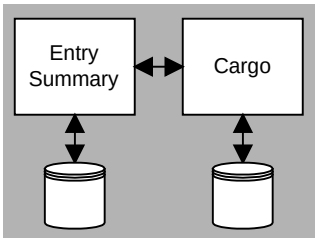
- ACS has evolved into a highly complex environment which continues to be the mission critical transactional engine for USCS.
- The technology has stayed the same but the size of the environment has grown significantly.
- Below are indications as to the current size and volume of ACS:
  - ACS is comprised of 3,179 COBOL programs (6,000,000 lines of COBOL code).
  - There are 1,000 CA Datacom databases.
  - There are 3,000 database tables consisting of 3.9 billion records of data.
  - The databases range in size from 1 million to 200 million records.
  - 1 million transactions are processed per day that result in 500 million database requests.
  - 65,000 daily batch jobs are run per day.
  - The volume is growing 20 percent annually.

Per the facts above, ACS has grown into a very large and very complex system. The diagram below illustrates the evolution of ACS from its inception to its current state.

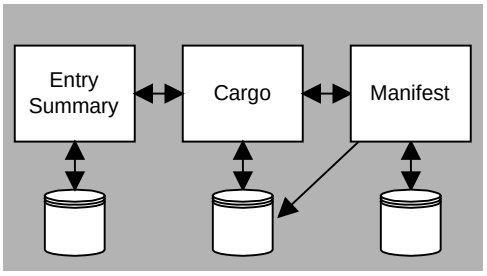
Evolution of ACS



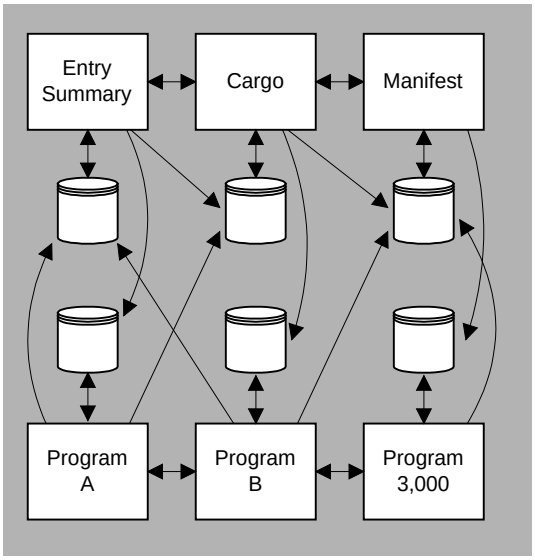
Initial deployment (Feb 1984)
Limited functionality
Architecturally clean
Appropriate documentation



Enhanced functionality
Interfaces between programs
Additional databases
Still architecturally clean
Limited documentation (minor issue at this point)



Continued enhanced functionality
Interfaces between programs
Additional databases
Beginnings of architectural compromises
Limited documentation (become more of an issue)



Current Environment (Dec 1997)
3,000 COBOL programs
6,000,000 lines of COBOL code
1,000 Datacom databases
1,000,000 transactions per day
500,000,000 database requests per day
Difficult to maintain due to dependencies.
Limited documentation (difficult to enhance system)

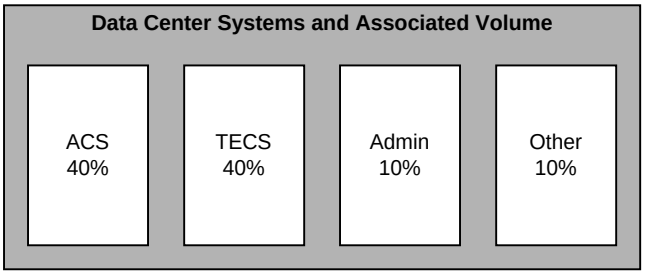
From an organizational viewpoint there are three units that are responsible for keeping ACS going. These organizations are described below.

- ACS Applications Area—This unit is responsible for the systems development and maintenance efforts of ACS. Additionally, this group has the business knowledge of what is in the system and works with the Trade and government organizations to understand the functionality that is needed / desired.
- Testing / Quality Assurance Area—This is a dedicated team of individuals who are responsible for ensuring a quality product is released into the production environment. This area is responsible for testing ACS as well as other systems.
- Data Center—This area is responsible for ensuring the system is physically running and available to USCS and the Trade. This includes the mainframe machines, system software, telecommunications, databases and the disk space required to store all the information.

Organizations Involved in Keeping ACS Running

As described above, the data center is responsible for systems other than ACS. Below is a diagram illustrating a high-level view of the data center system responsibilities and the associated volume breakdown for each major system.

USCS Data Center Systems



(Note: TECS = Treasury Enforcement Communication System)

4.0 ACS THE SYSTEM

4.1 ACS SYSTEM ARCHITECTURE

This section will document the system architecture of ACS. It will begin with a high-level view followed by a more detailed representation of the actual technology components that comprise ACS.

High-Level View

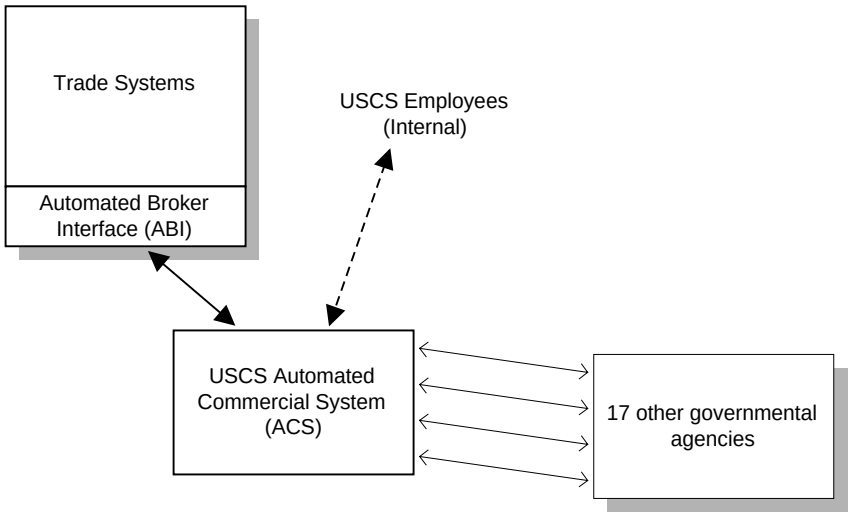
From a business point of view, the overall ACS environment consists of two elements; namely, the Trade's systems and the ACS system.

The Trade's systems can be large and complex. Over the years these systems have been customized to represent the Trade's business processes. In order to gain an appreciation of the complexity of these systems, we were told that the Trade's systems can have five to ten lines-of-code for each line-of-code in ACS.

ACS is also very large (as previously described). From a USCS perspective there are three primary users of ACS: the Trade, USCS employees, and other government agencies. The Trade primarily communicate with ACS through a mechanism called the Automated Broker Interface (ABI). The ABI can be thought of as a proprietary electronic data interchange (EDI) process that is required to interact with ACS. Internal users (i.e., USCS employees) use ACS in its natural fashion and don't require any proprietary interface mechanism.

The diagram below illustrates the major constituencies of ACS.

High-Level View of ACS

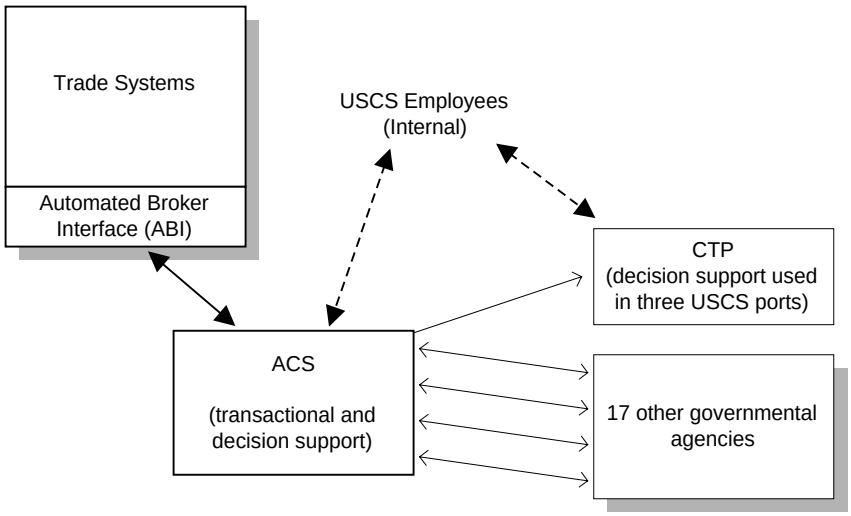


ACS is used primarily as a transactional system and secondarily as a decision support engine. However, the same hardware and software environment performs both the transactional and decision support activity. Naturally, this can cause a significant drain on available system resources. In fact, due to the processing demands currently occurring, the data center is forced to proactively and aggressively manage the systems environment to ensure defined levels of performance are maintained.

The Consolidated Targeting Prototype (CTP) is a decision support solution that has been deployed under the ACE umbrella. The CTP project is essentially a data warehousing solution that allows USCS to perform "targeting" efforts on incoming shipments. It is currently deployed in three ports (Savannah, GA; Los Angeles, CA; Seattle, WA).

Below is a diagram illustrating how some decision support functionality was off loaded to a separate environment which is currently supported by USCS.

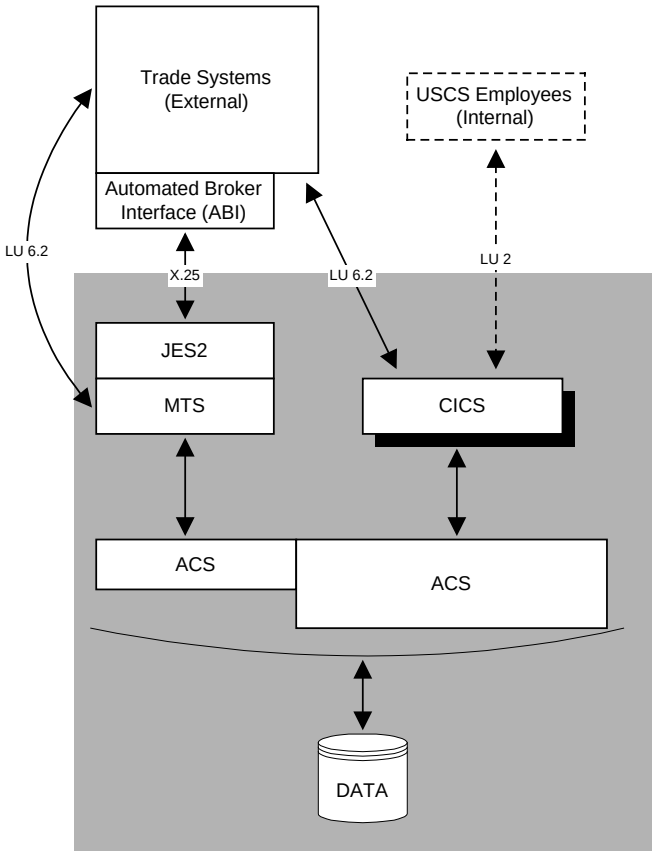
High-Level View of ACS



Technology View

This section will identify the major technology components found in ACS the system. Below is a diagram illustrating the major elements followed by a more thorough description for each of the components.

Major Technology Components of ACS



Shaded area = IBM MVS operating system (mainframe)

JES2 = Job Entry Subsystem 2 (provided by IBM)
MTS = USCS developed middleware
CICS = Middleware (provided by IBM)
ACS = COBOL programs
DATA = Compuer Associates Datacom databases

Data center provides operational support for MVS.

Data center provides application support for MTS.

ACS application team provides support for ACS programs.

Data center provides application support for databases.

A few facts regarding volume/size of ACS environment:
- 3,000 COBOL programs
- 6,000,000 lines of COBOL code
- 1,000 Datacom databases
- 1,000,000 transactions per day
- 500,000,000 database requests per day

- MVS—IBM's mainframe operating system.
  - The ACS programs and data run on top of MVS.
  - The data center organization is responsible for MVS and the mainframe environment as well as all operational activities associated with the USCS computing infrastructure.
- JES2—Job Entry System 2 is an IBM-provided facility which acts as a manager for requests from the Trade systems. It manages these requests by scheduling them to be run and subsequently stores the ACS result file that is to be transmitted back to the Trade system.

- MTS— A USCS internally developed middleware solution. This solution dates back to the origin of ACS. It was initially developed to keep the external community at arms-length from the actual ACS system and associated data (i.e., extra layer of security).
  - MTS is developed in a version of COBOL that is no longer supported by IBM.
  - Additionally, the application logic is very complex, performs logic that is not supported by IBM, and the intimate knowledge required to modify MTS has since left USCS.
  - The application support (i.e., program changes) and the operational support reside with the data center organization.
- CICS—Customer Information Control System is an IBM-provided middleware solution. It provides essentially the same functionality that is found in MTS.
  - CICS is utilized by internal USCS personnel and is recognized as the industry standard transaction processing monitor on MVS.
  - Additionally, CICS is currently being used by the Ocean and Rail segment of AMS.
- ACS—Represents the 3,000 COBOL programs (6,000,000 lines of code) that perform the application logic.
  - The programs that interact with MTS are a subset of the overall application portfolio.
  - These ACS programs are maintained and enhanced by the ACS development organization.
- DATA—Represents the 1,000 Computer Associates Datacom databases utilized in the ACS application.
  - As stated earlier several of these databases are very large (e.g., more 100,000,000 records).
  - The data center organization is responsible for all aspects of the databases. This includes operational as well as application support.

4.2 CURRENT ACS CHALLENGES

A key objective of this study is to determine under what conditions (and when) might ACS collapse or begin to degrade. The unfortunate reality is that ACS is already experiencing performance challenges. The data center currently aggressively addresses this issue by "throttling" the system when and where appropriate to ensure the Trade's performance remains at acceptable levels.

In order to quantify a point in time which the system collapses the following scenario is provided: Assuming everything remains just as it is today, the size of the databases will reach the physical capacity and ACS will no longer be operable around July 1998.

The ACS databases are extremely large and are becoming increasingly difficult to manage. In addition to the physical limits that the database is encroaching upon, it continues to be a challenge to perform the necessary database maintenance to ensure adequate levels of performance.

ACS currently faces challenges in regards to response time and system performance. When the system performance decreases the users of the system either a) go in to a "manual" mode of operation or b) in thinking their initial request was not transmitted to USCS, resubmit their request which results in ACS running the same request twice and putting an additional load on the system.

The data center has functioned admirably in addressing these challenges by performing system upgrades consisting of hardware and/or software. These changes are invisible to the user and the ACS development team but require significant effort. Each time the data center performs a system upgrade it requires effort to ensure the accompanying parts of ACS continue to operate in harmony. For example, when a new version of MVS is installed, it may require a new version of the database management system (CA Datacom) as well as modifications to MTS.

The database continues to encroach on the physical limits of the hardware/software and is increasingly taking more time to perform database maintenance (e.g., "re-index") in order to conserve disk space and improve performance. Without fundamentally addressing several key areas of risk, USCS faces the very real possibility of:

- Not being able to upgrade the data center computer hardware and/or operating systems.
- The database exceeding the physical limitations of the computer system.

The remainder of this section will itemize the current challenges facing ACS and will document a recommendation for each challenge. The challenges will be divided into those items that are non-discretionary (i.e., USCS must do regardless of strategic direction) and discretionary (i.e., would depend on strategic USCS path).

Current ACS Challenges

Challenge	Description	Recommendation
Non-Discretionary Items		
Year 2000	• Address Year 2000 challenges in ACS 3,000 programs (6 million lines of COBOL code). • ACS is in the process of executing an impressive Year 2000 effort. • This effort is on-schedule and expected to be completed by 1999.	• Continue as planned. • Ensure adequate levels of staffing are available for development and testing.
Data Volume	• Archiving of data occurs only in limited areas. • The data volumes are encroaching on the current physical limits of MVS. • Database maintenance takes several days to perform. • Without maintenance, db will take up more space and performance will degrade. •	• Formalize data archive process across entire ACS application. • Implement newer and cheaper archive media.
MTS	• Built with a version of COBOL that is no longer supported by IBM. • The MTS application performs complex and non-supported functions (e.g., directly manipulates operating system environment). • USCS no longer has personnel expertise of MTS application. • Operating system upgrades are increasingly incompatible with MTS. • USCS will reach a point where they must either a) run a non-supported IBM operating system or b) modify / replace MTS.	• Replace MTS with IBM's CICS.
Disaster Recovery	• USCS is working toward an improved recovery plan.	• Implement a formal disaster recovery plan.

Current ACS Challenges (Cont'd)

Challenge	Description	Recommendation
Discretionary Items		
Document ACS	• The ACS system documentation is less than desired. • In order to maintain and possibly extend the application the system documentation needs to reflect the current environment. • Without an acceptable level of documentation it is difficult to identify the impact of a change request. • For example, it may be relatively simple to make a specific enhancement but there may be many downstream implications to this change.	• Define the use and degree to which documentation is required. • Perform the agreed to level of documentation.
Future of CA Datacom	• GartnerGroup does not view CA's Datacom database management system as a strategic solution. • USCS does not view CA's Datacom product as strategic for their solutions. • If this is not addressed, USCS will find themselves supporting an increasing level of CA's maintenance costs as other organizations migrate away from this non-strategic DBMS. • IBM's DB/2 is the clear product of choice for a database management system on the mainframe. • This issue needs to take into consideration the future role of ACS.	• Where appropriate, implement DB/2.
ACS System Architecture	• Currently, the system architecture is quite intertwined. • Where the ACS system architecture should be architected to enable an evolution or migration to the future environment.	• Where appropriate, evolve ACS system architecture.

5.0 AVAILABLE OPTIONS/SCENARIOS

This section will present two options available to USCS in regards to ACS. The information that is documented in this section was identified collaboratively with USCS personnel and reviewed by the management of the data center and the ACS software development team.

The costs identified in this section reflect non-discretionary spending. The figures do not include those efforts which are viewed as optional and are dependent on longer term issues (e.g., migration to DB/2).

Each option will identify the following:

- Elements included in the alternative
- Implications of choosing the alternative
- Costs associated with the alternative.

5.1 SCENARIO 1: NO CHANGES TO ACS

This option illustrates the status quo. If ACS continues on as-is, this option itemizes the areas of risk as well as the costs.

Elements Included	• Continue with ACS Year 2000 efforts. • The ACS application remains in its current architectural form and functionality. • Retain minimum level of application support personnel to perform only mandatory enhancements/modifications. • Retain minimum level of data center personnel to perform required operational and database activities.
Implications	• Volume continues to grow at 20 percent annually. • Databases will exceed physical processing capacities around July 1998 and system becomes inoperable. • Data center may be forced to run non-supported version of operating system due to incompatibilities with MTS.
Costs	• The ten-year projected cost for this scenario is $292,000,000.

On the following page is a detailed breakdown of the costs per year for this scenario.

Scenario 1: No Changes to ACS (Cont'd)

Costs per Year

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Government Services	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 20.0
Maintenance (contractors)	2.0	2.5	4.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	26.0
Year 2000	4.0	2.5									6.5
Document ACS System											0.0
Archive / database efficiency											0.0
MTS (replace with CICS)											0.0
Testing / Quality Assurance	4.0	3.5	3.0	2.3	2.3	2.3	2.3	2.3	2.3	2.3	26.3
DASD Growth (data center)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.0
Operations (data center)	9.6	11.0	12.7	14.6	16.8	19.3	22.2	25.5	29.3	33.7	194.7
Equipment upgrade (data center)	2.5		2.5		2.5		2.5		2.5		12.5
Yearly Total:	24.7	22.1	24.8	22.0	26.7	26.7	32.1	32.9	39.2	41.1	292.0

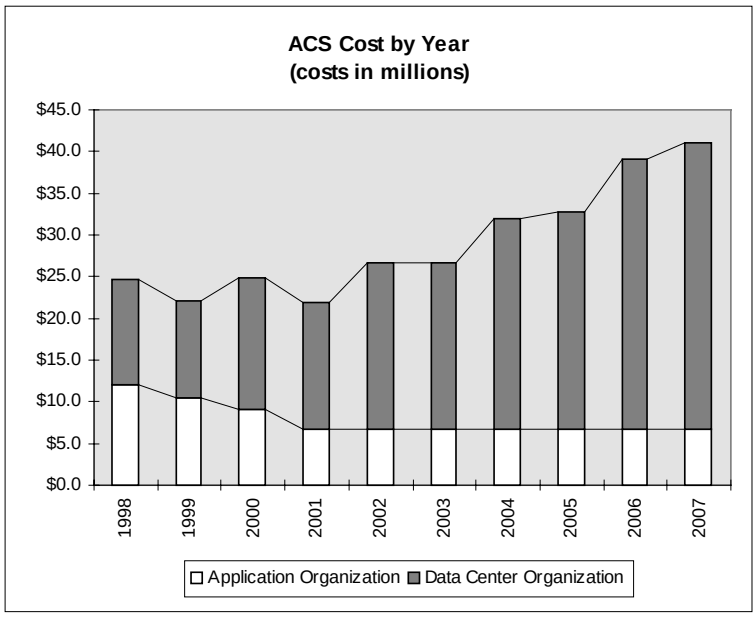
The following assumptions were used in arriving at the above figures:

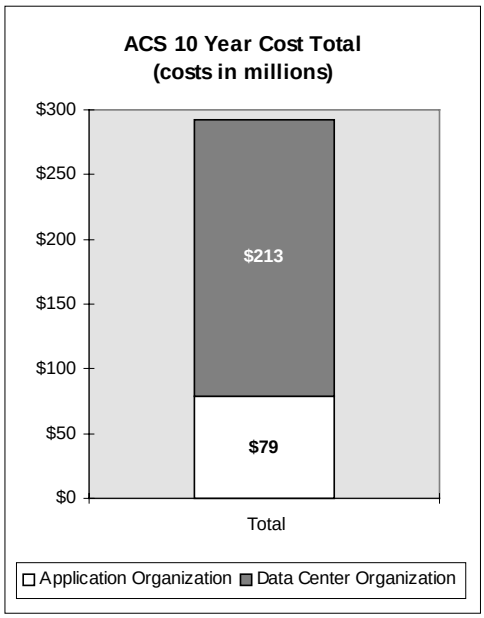
- Government services
  18 analysts, 18 programmers, and management.
- Maintenance
  Level of contractors required to keep ACS running.
- Year 2000
  Per the current plan this effort is expected to be completed in 1999.
- Testing / Quality Assurance
  This represents Testing and Quality Assurance area. It is calculated to be fifty percent of the application efforts.
- DASD Growth
  These costs are reflective of experienced growth history.
- Operations (data center)
  This includes all data center operational responsibilities. These numbers were obtained by allocating 40 percent of the overall data center costs to ACS. This assumption was based on the fact that 40 percent of the data center volume is associated with ACS.

- Equipment upgrade (data center)
  These costs are based on the history of required upgrades and vendor releases at USCS data center.

Scenario 1: No Changes to ACS (Cont'd)

Below is a summary of the costs for this scenario over a ten-year period.





5.2 SCENARIO 2: MINIMUM SPENDING ALTERNATIVE

This option illustrates the minimum amount of effort and associated spending to keep ACS operational.

Elements Included	• Continue with ACS Year 2000 efforts. • Archive old data. – The data center will need to ensure equipment is available and operable. – The ACS team will need to ensure application logic can access the archived data. • Replace MTS with IBM's CICS. – This will require a joint effort between the ACS development team and the data center team. • Document the system. • Retain minimum level of application support personnel to perform appropriate enhancements / modifications. • Retain minimum level of data center personnel to perform required operational and database activities.
Implications	• Volume continues to grow at 20 percent annually. • Risk of reaching physical limits of database size will be significantly relieved as older data is placed on archived media. • Performance issues will improve (due to less records to read). • USCS will no longer need to support MTS and its proprietary implementation.
Costs	• The ten-year projected cost for this scenario is $324,400,000.

On the following page is a detailed breakdown of the costs per year for this scenario.

Scenario 2: Minimum Spending Alternative (Cont'd)

Costs per Year

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Government Services	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ 20.0
Maintenance (contractors)	2.0	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	36.5
Year 2000	4.0	2.5									6.5
Document ACS System		3.5	3.5								7.0
Archive / database efficiency		0.6									0.6
MTS (replace with CICS)		2.0	1.5								3.5
Testing / Quality Assurance	4.0	6.6	5.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	37.1
DASD Growth (data center)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.0
Operations (data center)	9.6	11.0	12.7	14.6	16.8	19.3	22.2	25.5	29.3	33.7	194.7
Equipment upgrade (data center)	2.5		2.5		2.5		2.5		2.5		12.5
Yearly Total:	24.7	31.3	32.3	24.2	28.9	28.9	34.3	35.1	41.4	43.3	324.4

The following assumptions were used in arriving at the above figures:

- Government services
  18 analysts, 18 programmers, and management.
- Maintenance
  Level of contractors required to minimally modify ACS (when required).
- Year 2000
  Per the current plan this effort is expected to be completed in 1999.
- Document ACS System
  The amount of this effort was estimated by a previous USCS effort at $7 million. We have reflected that same number but it may be less than this amount depending on the level of documentation that is required.
- Archive / database efficiency
  This amount includes the effort required to change the ACS application logic to access data stored on archived media.
- MTS (replace with CICS)
  This estimate represents the effort required to change the ACS application logic to communicate with CICS (instead of the current MTS). It was felt that since the

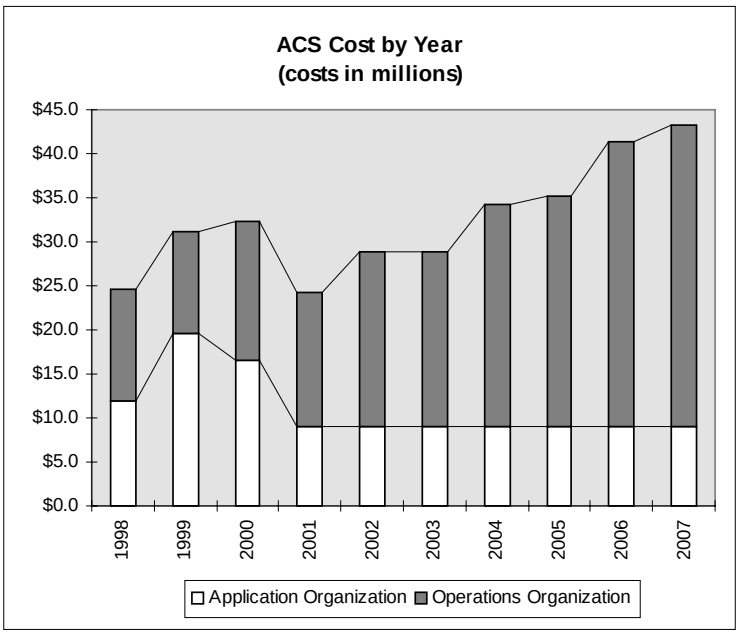
data center is already supporting CICS the additional cost to support it for ACS can be absorbed with minimal impact.

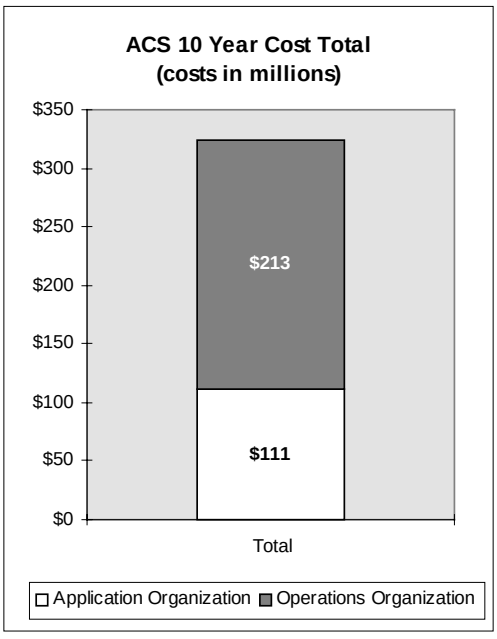
Scenario 2: Minimum Spending Alternative (Cont'd)

Cost assumptions (Cont'd)

- Testing / Quality Assurance
  This represents Testing and Quality Assurance area. It is calculated to be fifty percent of the application efforts.
- DASD Growth (data center)
- These costs are reflective of experienced growth history.
- Operations (data center)
  This includes all data center operational responsibilities. These numbers were obtained by allocating 40 percent of the overall data center costs to ACS. This assumption was based on the fact that 40 percent of the data center volume is associated with ACS.
- Equipment upgrade (data center)
  These costs are based on the history of required upgrades and vendor releases at USCS data center.

Below is a summary of the costs for this scenario over a ten-year period.





6.0 TECHNOLOGY ASSESSMENT

6.1 CA-DATACOM DATABASE

We believe that IDMS and Datacom are not regarded by Computer Associates (CA) as strategic DBMSs, although CA has a commitment to continue to support and enhance these products, and new releases of both products have been in beta test this year. CA's more strategic DBMS product is CA-OpenIngres, although the object-relational hybrid technology (Jasmine) based on the partnership with Fujitsu has somewhat displaced even OpenIngres. We believe that CA has delivered new functionality and ports to new platforms more slowly for CA-IDMS than for CA-Datacom (as well as more slowly than IBM has for IMS and DB2 and Software AG has for Adabas), largely due to the more complex structure of the IDMS database and code base.

After an initial wave of migrations off legacy database management systems (DBMSs), and mainframe DBMSs in general, there has been a trend toward the preservation of investments in legacy data and applications. Legacy DBMS vendors have focused new release improvements in three areas: enhancement of traditional strengths, modernization and connectivity.

Traditional strengths include availability, reliability, performance, support for large workloads and large number of concurrent users, and manageability. New releases have included increased progress toward 24x7 processing and performance and availability enhancements such as exploitation of Parallel Sysplex. Modernizing is done via enhancements to SQL interfaces that run atop these DBMSs, ports to other platforms (especially Unix) and features such as replication. In the area of connectivity, most of the legacy DBMS vendors offer some type of proprietary access to their mainframe product from Windows and, in some cases, from OS/2 or Unix.

Historically, CA achieved business success by dominating a particular market segment via acquisition. To build critical mass, CA acquired a significant number of brand-name software companies, which over time has created a portfolio of more than 600 products. However, as the company has grown, it has become increasingly clear that future acquisitions will be only half as important to CA as they were before. CA is proceeding with alternate tactics to attain dominant market share and account control. These tactics are to lock up the marketplace through outsourcing agreements and increase market share with internally developed products—in segments that CA intends to dominate.

However, we believe that the degree of product lock-in for new and emerging markets is not as attainable, as has been historically achievable in the mainframe environment. To gain account control, CA is attempting to own both the technology agenda and ongoing user contract commitments.

6.2 MVS Operating System

IBM's MVS family of systems has traditionally driven the largest and most demanding OLTP and database systems in the industry. Although the technology transition from ECL to CMOS created a discontinuity in the performance characteristics of the system, subsequent announcements have improved the performance to approximately 70 percent of the H5 level of technology, and, in June 1997, IBM has regained H5 equivalence with a 63-MIPS processor. (H5 refers to systems based on the 62-MIPS uniprocessor—also referred to as the 711-based series.) IBM's strategy for achieving high levels of performance is to cluster systems by using Parallel Sysplex hardware and software capabilities. IBM enterprise customers that require concurrent OLTP support for 10,000 to 20,000 users are able to implement these systems under MVS. The largest TP system in the world runs on a seven-system cluster under IBM's Transaction Processing Facility and can process 5,000 transactions per second.

IBM MVS and S/390 achieve the extremely good rating in the high-availability category because of the design criteria implemented. MVS has been designed with a focus on avoiding system outages whenever possible. Combinations of hardware and software have made possible such availability features as storage protect keys that prevent an application from modifying the OS or another application. Clustering through Parallel Sysplex in a shared-data environment allows for automatic restart of CICS v.4.1, DB2 v.4.1, and IMS v.5.1-based applications and related processes on a different environment if a system failure occurs. It is the cumulative effect of hardware and software clustering capabilities that enabled IBM to earn a high score in this category.

MVS lags substantially behind many other vendors in the area of ISV enthusiasm. Although there is a large portfolio of tools and middleware, there is relatively modest availability of newer client/server applications based on portable RDBMSs such as Oracle, Informix and Sybase. With the addition of the Unix APIs into MVS and the Unix branding of OS/390, IBM has undertaken a significant effort to attract ISVs to the MVS world. Although there has been progress and a large number of ISVs have stated support, it is too early to evaluate the real effectiveness of the program.

IBM's MVS and S/390 earned a solid rating for its highly impressive combination of geographic coverage and physical infrastructure to identify, report and resolve problems in both hardware and software. Maintenance is a long-term strength of IBM's, and that strength has been bolstered by the company's willingness to work with other suppliers to resolve software or hardware failures.

The greatest MVS weakness is in the area of interoperability, whereas the highest score was for transitions, reflecting the excellent manner in which IBM has managed migration to CMOS-based systems and the Parallel Sysplex environment.

MVS has a strong suite of systems management tools and programs that was significantly strengthened with its acquisition of Tivoli Systems. The score of seven in this area reflects GartnerGroup's positive assessment of MVS's capabilities in systems management.

6.3 CICS

IBM's On-Line Transaction Processing (OLTP) strategy since 1969 has centered on CICS, with IMS as a significant alternative. CICS was a huge success when mainframes dominated OLTP, and it still runs many of the world's critical OLTP jobs. As recently as 1991, IBM held 49 percent of the U.S. OLTP market and 35 percent of the worldwide OLTP market through a combination of CICS, IMS and OS/400.

IBM's primary OLTP strategy is to extend the life and usefulness of mainframe CICS applications by making them more accessible to front ends running elsewhere on the network. IBM has a growing array of distributed-computing extensions to CICS, including World Wide Web interfaces and numerous PC and Unix connectivity products that help enable such "application mining." It also jointly markets third-party tools such as Planetworks' Interspace that make it easier for PowerBuilder, Visual Basic, Java and other front ends to connect into mainframe CICS. We expect that these efforts will bolster IBM's OLTP revenues during the next two years. However, these tools are not likely to reverse the gradual decline in IBM's OLTP market share because they do little to attract the server side of new OLTP applications. IBM realizes that ISVs are unlikely to produce new OLTP applications for MVS and that almost all enterprise MVS development only extends or modifies applications. Therefore, IBM's strategy for new OLTP (server) applications is to keep pushing Encina and CICS on Unix and NT.

6.4 MTS

MTS is a proprietary Transaction Processing (TP) facility built by the Systems Operations Division of USCS. Similar in function to CICS, it performs the OLTP function for the ACS system by acting as the TP Monitor between ABI (JES 2 spool), MVS system resources and ACS transactions.

The ACS system faces immediate risk in the continuing use of the MTS OLTP. Operating System (MVS) patches and application software upgrades are currently predicated on successful testing and modifications of MTS middleware to support low level, unique, design intricacies of the MTS TP. GartnerGroup recommends an immediate transition to available vendor OLTP facilities, such as CICS (IBM).